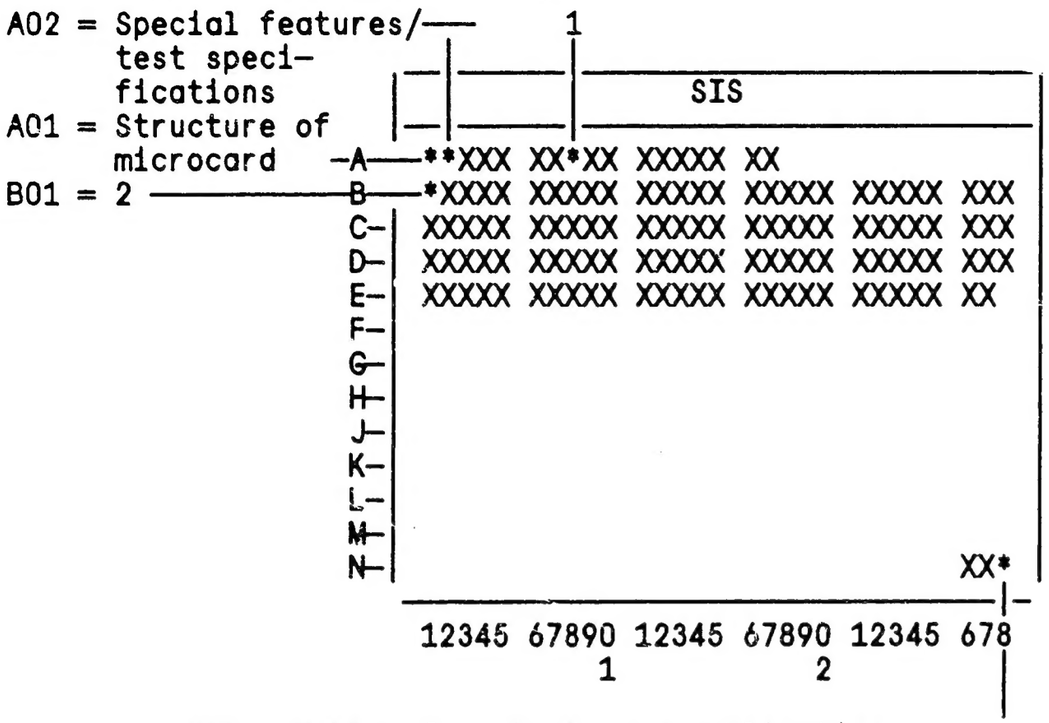
STRUCTURE OF THE MICROCARD



N28 = Table of contents and publication information
1 = Tools and devices
2 = Complete instructions, divided into test steps (no references)

a. Read from left to right.

b. Title of micropicture (appears on each coordinate).

E16	Product/component/test step	

Coordinate

c. Limits of section

===>	<===>	<===	=> <=
Beginning	Mid-section	End	One-page section

A01	—	=> <=

SPECIAL FEATURES

These test instructions apply to the

VE distributor-type fuel-injection pumps 0 460 4..
(VE..E..)

and describe electrical/hydraulic testing as well as setting of the quantity injected. Friction assessment (hysteresis testing) is not treated.

The quantity of fuel injected is controlled by way of a moving-solenoid positioner. The positioner acts directly on the mechanical injected-quantity control (control spool) by means of a shaft. With the start-of-injection positioner, the pressure is set at the timing-device piston via a pulsed solenoid valve. The current fuel temperature is recorded by way of the temperature sensor (fuel).

A02	—	=> <=

SAFETY AND PRECAUTIONARY MEASURES

1. Given a constantly set check-back voltage, the pump may not be operated for more than 15 minutes.

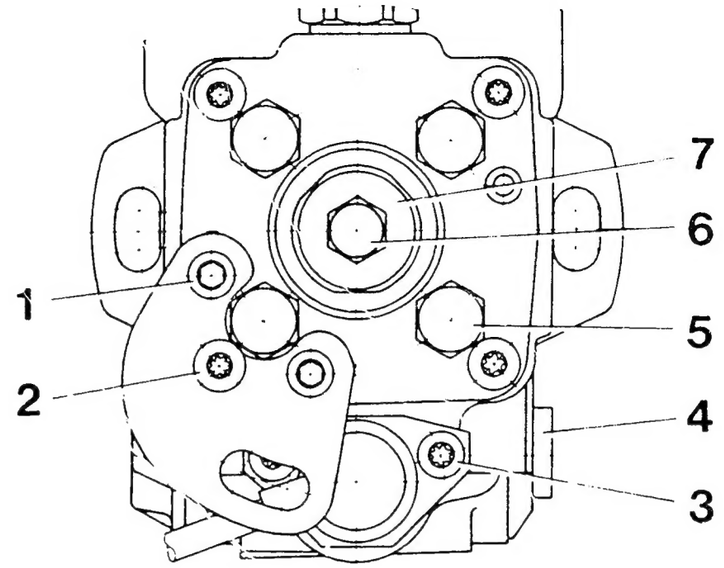
2. The max. check-back voltage is not to be adjusted with the pump running.

3. The tester EDC-VE is only to be switched on when inflow of calibrating oil has been ensured.

4. The contacts of the electrical plug connections are not to come into contact with calibrating oil. If calibrating oil has ingressed, the plug connected is to be cleaned using compressed air.

5. Maximum cleanliness is to be ensured when working on the injected-quantity adjuster. Contact with the potentiometer track and wiper of the control-collar travel sensor is to be avoided and the above items are not to be cleaned. The use of cleaning agents is not permitted.

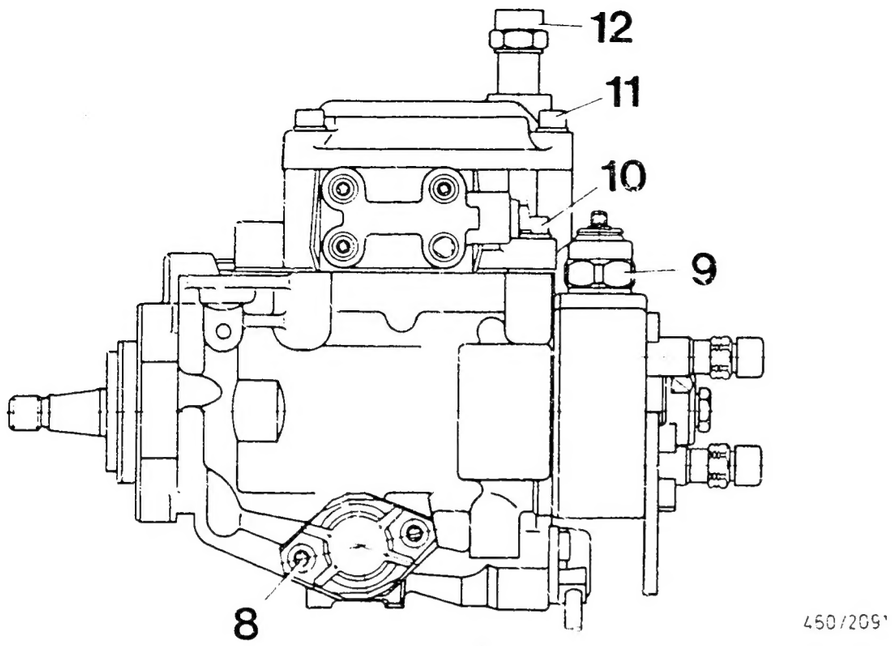
6. Any foreign matter in the injected-quantity adjuster is to be removed and the adjuster itself renewed if necessary. If foreign matter remains in the injected-quantity adjuster during operation, this may lead to serious impairment of function.



460/2090

TIGHTENING TORQUES

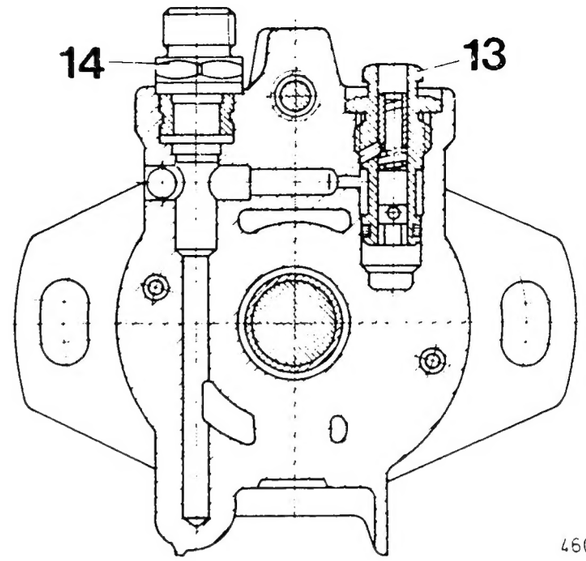
No.	Designation	Tightening torque (Nm)
1	Fillister-head screw/ hexagon-socket-head cap screw	7...10
2	Fillister-head screw/ Torx screw	10...14
3	Fillister-head screw/ Torx screw	10...14
4	Fillister-head screw/ Torx screw	10...14
5	Delivery-valve holder	38...48
6	Vent screw	26...32
7	Screw plug	70...90



460/2091

Tightening torques (continued)

No.	Designation	Tightening torques (Nm)
8	Fillister-head screw Torx screw	 10...14
9	Solenoid valve	15...25
10	Fillister-head screw Torx screw	 7...10
11	Fillister-head screw Torx screw	 7...10
12	Inlet-union screw	20...30



460/2092

Tightening torques (continued)

No.	Designation	Tightening torque (Nm)
13	Pressure regulator	7...10
14	Tube fitting	20...30

GENERAL

Item numbers:
The item numbers given in the text do not correspond to the item numbers in the service-parts list.

Note on test specifications:
A test-specification microcard is required for testing the distributor-type fuel-injection pump VE..E..

Notes on delivery testing and adjustment:
When setting the distributor-type fuel-injection pump, the only applicable values are those given in the test-specification sheet and not in parentheses (settings).

Notes on functional test (incoming inspection)
Electrical test:
Electrical testing is to be performed before hydraulic testing.
For the purposes of this test, the fuel-injection pump is not clamped in position on the injection-pump test bench.

Hydraulic test:
If the distributor-type fuel-injection pump is only tested as to its function and setting w i t h o u t p r e v i o u s repair, use is to be made for this test of the test-specification-sheet values in p a r e n t h e s e s (check values).
If a correction has to be made to the distributor-type fuel-injection pump, the test specifications which are n o t i n p a r e n t h e s e s apply (settings).

Notes on trouble-shooting chart:
The causes listed in the trouble-shooting chart refer to the repair instructions for the VE..E pump.

Calibrating oil:
The calibrating oil must be in line with the ISO Standard 4113. It must not be mixed with or contaminated by lubricating oil or diesel fuel from the fuel-injection pump, since this biases the measured values.

The prescribed calibrating-oil temperature is between 40 and 48°C in the return line when using the temperature indicator 1 687 230 029. The range 42-50°C applies when using the temperature sensor with electrical reading.

Viscosity test:
Test equipment:
1. Collector with lid
2. Thermometer with protective conduit and holder
3. Viscosity test cup
4. Stopwatch (not part of scope of delivery)
(Items 1-3 = KDEP 1500)

Test intervals (depending on degree of utilization of test bench):
- 1 x per week (in accordance with ISO Specification 4008/III)
- At the latest after testing 20 fuel-injection pumps or after roughly 35 hours of operation
- After not more than 6 months, if - in the meantime - no or less than 20 fuel-injection pumps have been tested.

Preparation:
Fill collector to roughly 3/4 level with f i l t e r e d calibrating oil from inflow line of test bench. Pay attention to absolute cleanliness. Even minute dirt particles (e.g. fluff in connector) lead to biasing of the measurement result.

Secure thermometer with protective conduit to inside of vessel. Immerse viscosity test cup in calibrating oil and leave it standing in calibrating oil for approximately 15 minutes. This makes for temperature equalization between the viscosity test cup and the calibrating oil.

Test procedure:
Pull viscosity test cup rapidly (within approx. 1 second) out of calibrating oil by means of chain (keep steady, do not allow to move back and forth, avoid spillage).
Stopwatch must be pressed when viscosity test cup emerges from calibrating oil.

Viscosity test:
If calibrating oil runs into the inside of the test-cup bore from the funnel-shaped part of the test cup, press stopwatch again and then read off/note down run-out time.

Repeat viscosity test until same measurement result (tol. +/- 0.3 seconds) is obtained.

If an identical result is not obtained after the 4th repetition, the viscosity test cup (e.g. fluff), the collector or the calibrating oil (filter in test bench) is dirty. Refer to section entitled "Preparation". Then repeat test again as described.

Compare measurement result to values in table.

Oil temperature (°C)	Permissible run-out time (Seconds)
10	82.0...89.5
11	81.0...88.5
12	80.5...87.5
13	80.0...86.5
14	79.0...86.0
15	78.5...85.0
16	78.0...84.0
17	77.5...83.0
18	77.0...82.0
19	76.5...81.5
20	75.5...80.5
21	75.0...79.5
22	74.5...79.0
23	74.0...78.0
24	73.5...77.5
25	73.0...77.0
26	72.5...76.0
27	72.0...75.5
28	71.5...75.0
29	71.0...74.5
30	70.5...74.0
31	70.0...73.5
32	69.5...73.0
33	69.0...72.5
34	68.5...72.0
35	68.2...71.5
36	67.8...71.0
37	67.5...70.5
38	67.0...70.0
39	66.5...69.5
40	66.0...69.0

If the measured time is not within the permitted run-out time tolerance, calibrating oil and calibrating-oil filter in the injection-pump test bench are to be replaced.

Cleaning viscosity test cup:
Do not clean inside of viscosity test cup by polishing it, but rather wash it out after every test with benzine, so as to avoid resinous residues in the run-out hole.

N e v e r clean run-out hole with a needle, since scoring in the hole would bias the measurement result.

Condition of test equipment:
Check injection pressure of calibrating nozzle-holder assembly and condition of nipples of test-pressure lines (use plug gauge) once a week, however at the latest after testing 20 fuel-injection pumps.
If necessary, check opening pressure of nozzle-holder assemblies and repair/renew fuel-injection tubing.

Assembly of test equipment:
The settings and check values indicated in the test specifications refer to precisely defined test equipment. The most important components of the test equipment are as follows: calibrating nozzle-holder assembly and test-pressure line.

Standard test equipment is not contained in the test-specification sheet; other test equipment is however listed.

Test conditions:
In order to obtain the prescribed values when effecting pump adjustment or checking, precise attention must be paid to the test conditions listed on the test-specification sheet, particularly with regard to inlet pressure and - if stated - a special overflow valve for suction-chamber flushing.

Notes on prestroke adjustment:
The following applies to all distributor-type fuel-injection pumps:

- The inlet pressure is 0.35 (+/- 0.1) bar
- Start-of-delivery has been reached when 1 droplet per second flows out at the overflow pipe

Delivery measurement:
Moisten inside of graduates before performing any measurements. To do so, allow calibrating oil to run in and graduates to drip off for 30 +/- 1 seconds.

After each measurement, allow graduates to run off for 30 +/- 1 seconds before carrying out new measurement. If the break following run-out is more than 10 minutes, wet graduates again.

When measuring a pump, keep calibrating-oil temperature constant within the stated tolerances.

Overflow temperature:
40...48°C in return line with temperature indicator (1 687 230 029).
42...50°C in return line with temperature-sensor measuring instrument.

With the KMM (continuous quantity measuring device) the maximum ambient temperature must not exceed 40°C.

Note:
With the prescribed test sequence, cooling-down or warming-up times are required, so as to keep the calibrating oil at the overflow temperature. Filament decoupling coil must not be switched on when performing measurement.
When reading off delivery, there must be no bubbles on the surface of the calibrating oil in the graduates. Take reading at refraction level on blue graduate stripe.

TOOLS AND TEST EQUIPMENT

Tools Test equipment	Type designation or part No.	Application
Tester EDC-VE	0 684 200 615	Testing VE..E.. distributor-type fuel-injection pump
Connecting lead (9-pole)	1 684 463 217 1 684 463 218 1 684 463 219	Connection between tester and injected-quantity adjuster
Connecting lead (3-pole)	1 684 463 221 1 684 463 220	Connection between tester and solenoid valve, start of injection
Multimeter	BOSCH MMD 301 0 684 500 301	Testing electrical components
Test adapter	KDEP 1165	Testing injected-quantity adjuster
Adapter lead BMW 524 td (E28) BMW 324 td BMW 524 td BMW 324 d Citroen CX 25 TD2 Peugeot 505 td	 KDEP 1165/100 KDEP 1165/300 KDEP 1165/300 KDEP 1165/300 KDEP 1165/200 KDEP 1165/200	Testing injected-quantity adjuster
Test leads	KDUM 0008	Testing solenoid valve, start of injection

TOOLS AND TEST EQUIPMENT (CONTINUED)

Tools Test equipment	Type designation or part No.	Application
Clamping flange	1 685 720 062	Pilot Diameter 50 mm for 2 and 3-hole mounting
Clamping bracket	1 688 010 124 1 688 010 129	Test benches EPS 7.., other test benches
Coupling half	1 686 430 024	
Calibrating nozzle-holder assembly		See test instructions
Fuel-injection tubing		See test specification sheet
Holding device	KDEP 1140	for nozzle-holder assemblies
Testing device	1 688 130 075	Measurement of inlet pressure and supply-pump pressure
(Pressure-gauge set with various connection parts)		
Measuring device	1 688 130 139	Measuring timing-device travel
Extractor	KDEP 1027	Pulling out clamping sleeve of control vlv.
Socket wrench	KDEP 1086	Screwing in and unscrewing control valve
Plastic hammer (approx. 300 g)	Commercially available	Setting delivery
Pressing-in tool	KDEP 1092	Setting supply-pump pressure

TOOLS AND TEST EQUIPMENT (CONTINUED)

Tools Test equipment	Type designation or part No.	Application
Pressing-in tool	KDEP 1093	Pressing in clamping sleeve of control valve
Prestroke measuring device	1 688 130 180 previously 1 688 130 045 or KDEP 2931	Setting prestroke
Extension piece	1 683 458 019	Thread M8 x 1
Dial indicator Scale division 0.01 mm with M 3 base thread	1 687 233 012	
Temperature indicator	1 687 230 029	Measurement of overflow temperature
Flushing valve		Maintenance of overflow temperature
Testing device	KDEP 1500	Viscosity test
Cover	KDEP 1180	Renewal of fuel temperature sensor

For production reasons:
continued on the following coordinate.

TROUBLE-SHOOTING CHART

Note:
The data given under "Cause" refer to pump repair.

Fault symptoms 1	2	3	4	5	6	Cause
*			*			KF-dimension too small
*						Ball of delivery valve sticking
*				*		Incorrect delivery valve
*						Piston base damaged
*						Supply pump impeller sticking or impeller incorrectly mounted
	*			*		Prestroke too small or too large
		*				Electric shut-off device (ELAB): incorrect shutoff solenoid, shutoff solenoid sticking, defective, dirty
				*		Sealing lip of central screw plug leaking
				*		Incorrect cam plate
					*	Timing-device piston and cam roller ring not moving freely. Incorrect supply pump pressure

TROUBLE-SHOOTING CHART (continued)

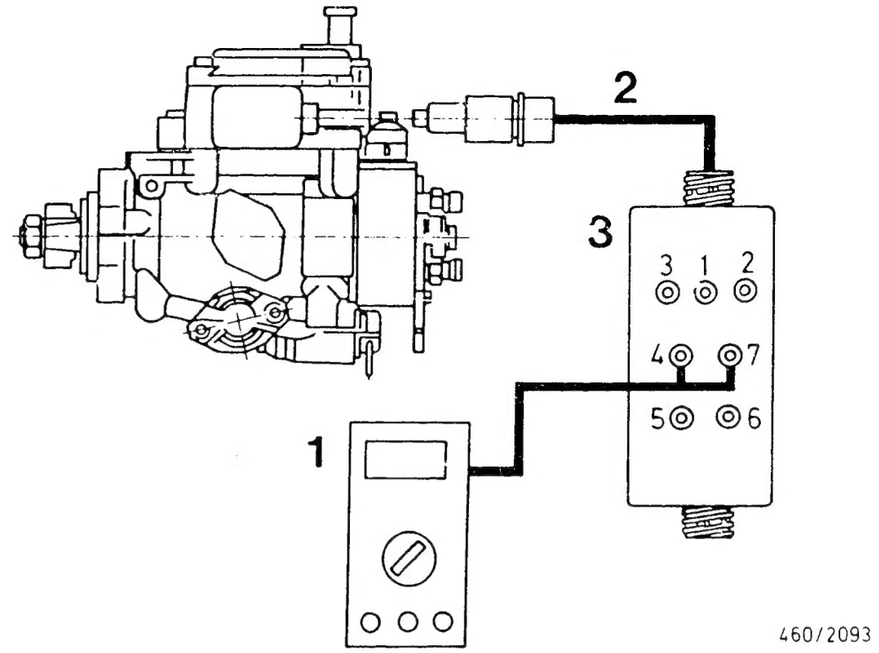
Note:
The data outlined under "Cause" refer to pump repair.

Fault symptoms 7	8	9	10	11	Cause
*	*				Ball of delivery valve sticking
*	*				Supply pump impeller sticking or impeller incorrectly fitted
			*		Prestroke too small or too large
			*		Electric shutoff device (ELAB): incorrect shutoff solenoid, shutoff solenoid sticking, defective, dirty
				*	Sealing lip of central screw plug leaking
*	*				Tilt clearance not within permitted tolerance
*					Lower O-ring of pressure regulator damaged
	*				Ball race installed turned through 180°
			*		Check timing-device disk size
				*	Control spool not moving freely

TROUBLE-SHOOTING CHART (continued)

Note:
The data given under "Cause" refer to pump repair.

Fault symptoms 12.	13.	14.	15.	16.	17.	Cause
*				*	*	Injected-quantity adjuster and/or control-collar travel sensor
*	*			*	*	Injected-quantity adjuster and/or control spool not moving freely, control-collar travel sensor
		*				Solenoid valve, start of injection
		*				Solenoid valve, start of injection, supply pump pressure incorrect
			*			Temperature sensor (fuel)
			*			Incorrect temperature sensor (fuel) fitted
				*	*	Excessive-fuel stop/shutoff stop Control-collar travel sensor



460/2093

1 = Multimeter
2 = Adapter lead (depending on plug version KDEP 1165/..)
3 = Test adapter KDEP 1165

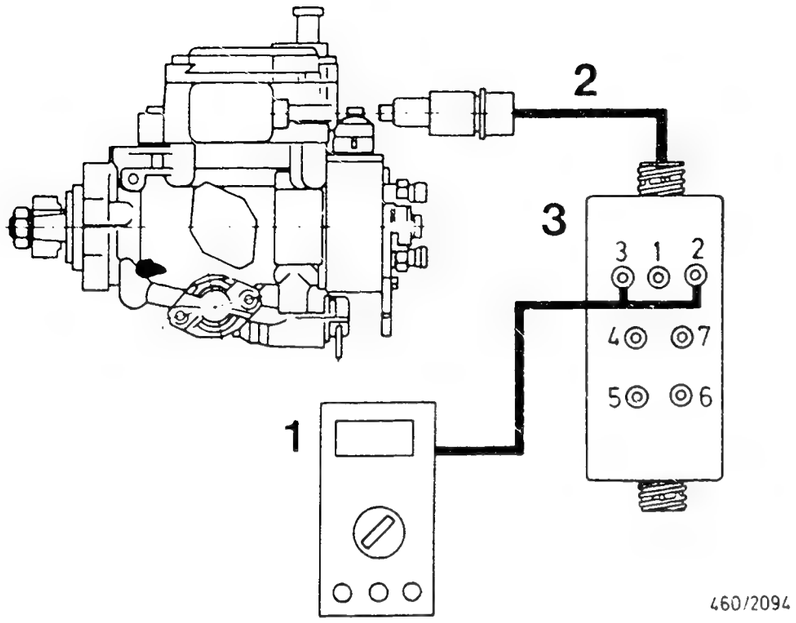
INCOMING INSPECTION OF PUMP (electrical testing)
Injected-quantity adjuster

Connect test adapter KDEP 1165 with suitable adapter lead to fuel-injection pump.
Connect multimeter with commercially available test leads to test adapter:
term.4 and term.7 then
term.4 and term.7 to ground.
Measure resistances.

Refer to test-specification sheet for set values.

If set values are attained, continue testing on Coordinate B05.

If set values are not attained, carry out repair in accordance with instructions. Then continue testing on Coordinate B04.



460/2094

1 = Multimeter
2 = Adapter lead (depending on plug version KDEP 1165/..)
3 = Test adapter KDEP 1165

Control-collar travel sensor

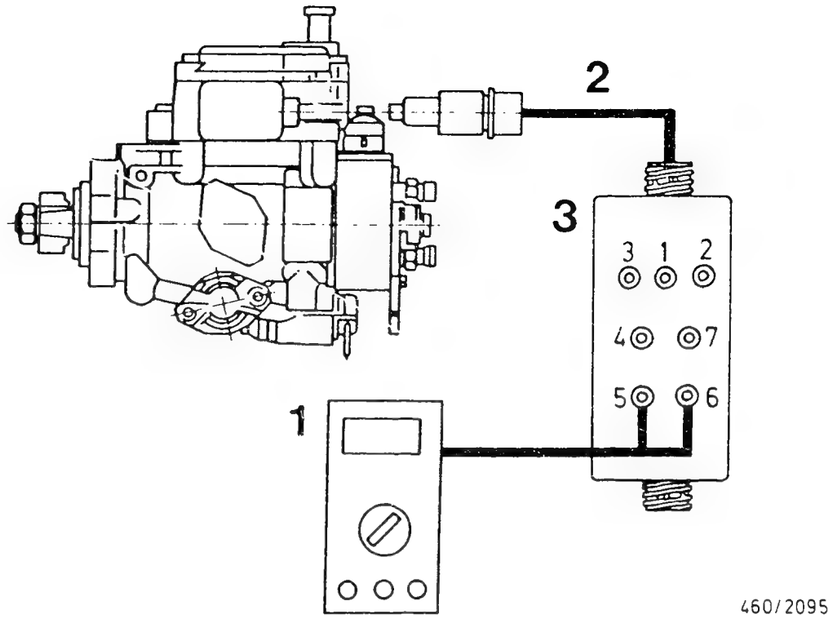
Connect test adapter KDEP 1165 with suitable adapter lead to fuel-injection pump.
Connect multimeter with commercially available test leads to test adapter:
term.2 and term.3, term.1 and term.3 then term.1, term.2, term.3 to ground.

Measure resistances.

Refer to test-specification sheet for set values.

If set values are attained, continue testing on Coordinate B06.

If set values are not attained, perform repair in accordance with instructions. Then continue testing on Coordinate B04.



460/2095

1 = Multimeter
2 = Adapter lead (dependent on plug version KDEP 1165/..)
3 = Test adapter KDEP 1165

Temperature sensor (fuel)

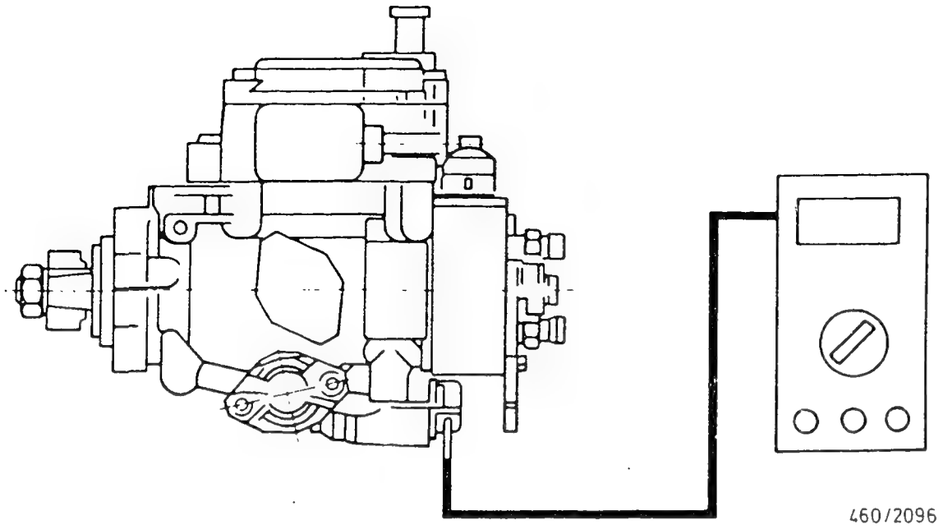
Connect test adapter KDEP 1165 with suitable adapter lead to fuel-injection pump.
Connect multimeter with commercially available test leads to test adapter:
term.5 and term.6 then term.5 and term.6 to ground.

Measure resistances.

Refer to test-specification sheet for set values.

If set values are attained, continue testing on Coordinate B07.

If set values are not attained, perform repairs in accordance with instructions. Then continue testing on Coordinate B04.



460/2096

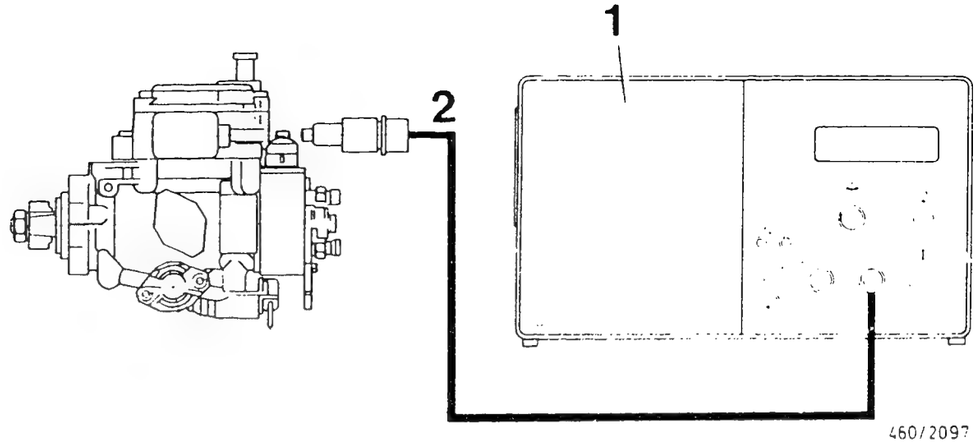
Solenoid valve, start of injection

Connect multimeter with test leads KDUM 0008
to solenoid valve:
term.1 and term.2 then
term.1 and term.2 to ground.

Measure resistances.

If set values are attained, continue
testing on Coordinate B08.

If set values are not attained, carry out
repairs in accordance with instructions. Then
continue testing on Coordinate B04.



460/2097

1 = Tester EDC-VE
2 = Connecting lead

Excess-fuel stop

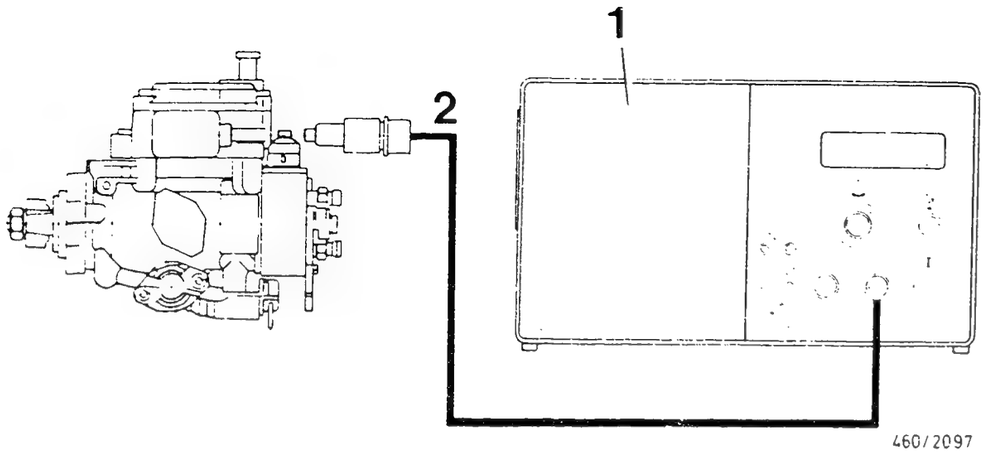
Note:
(A l w a y s observe so as to avoid damage
to injected-quantity adjuster).
The measurement time must not exceed 15
seconds.

Adjust check-back voltage to maximum value.
Read off check-back voltage.

Refer to test-specification sheet for set
value.

If set value is attained, continue testing
on Coordinate B09.

If set values are not attained, carry out
repair in accordance with instructions. Then
continue testing on Coordinate B04.



1 = Tester EDC-VE
2 = Connecting lead

Shutoff stop

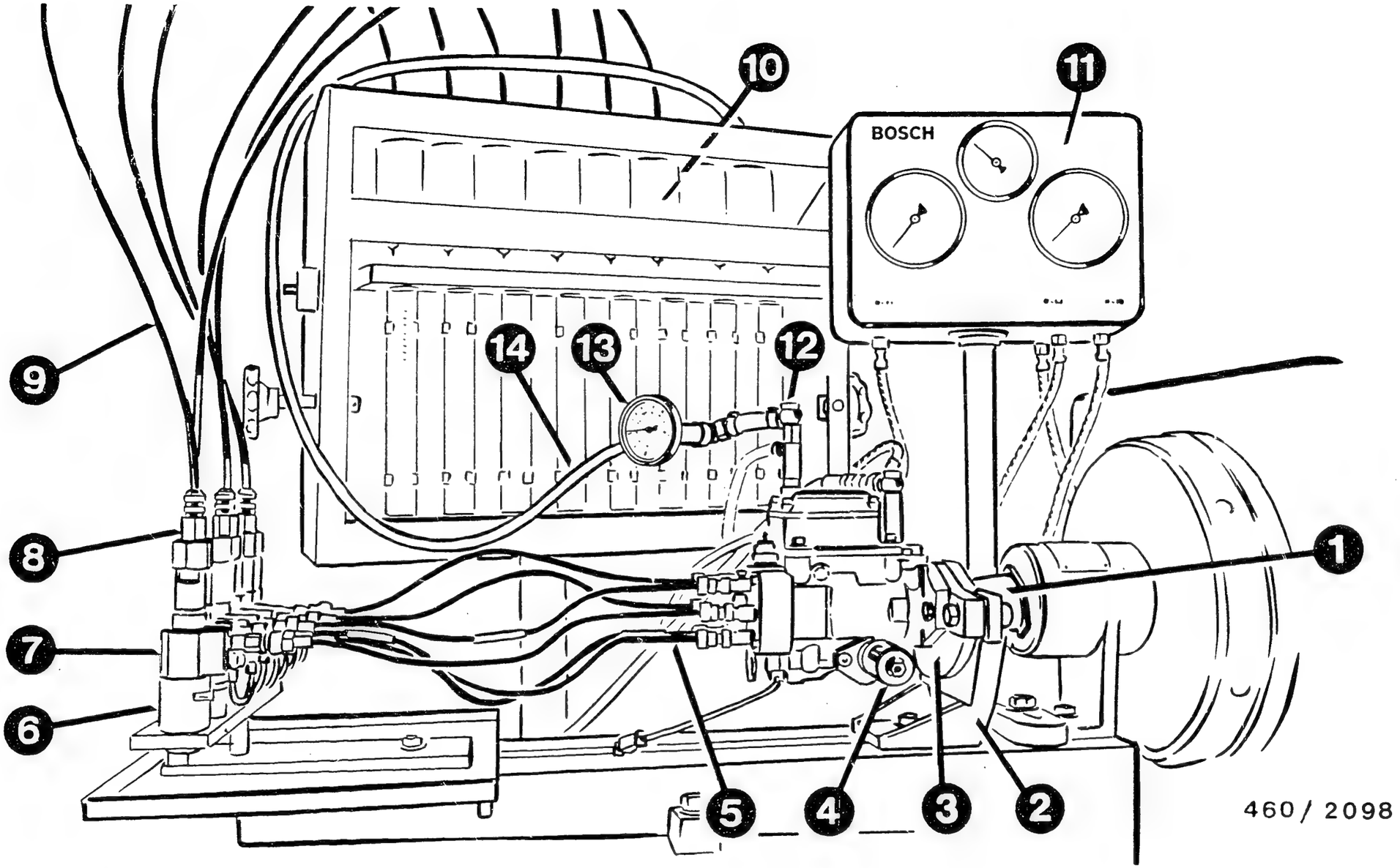
Adjust check-back voltage to minimum value.
Read off check-back voltage.

Refer to test-specification sheet for set value.

If set value is attained, continue testing
on Coordinate B11.

If set values are not attained, perform
repairs in accordance with instructions.
Then continue testing on Coordinate B04.

For production reasons:
continued on the following
coordinate.

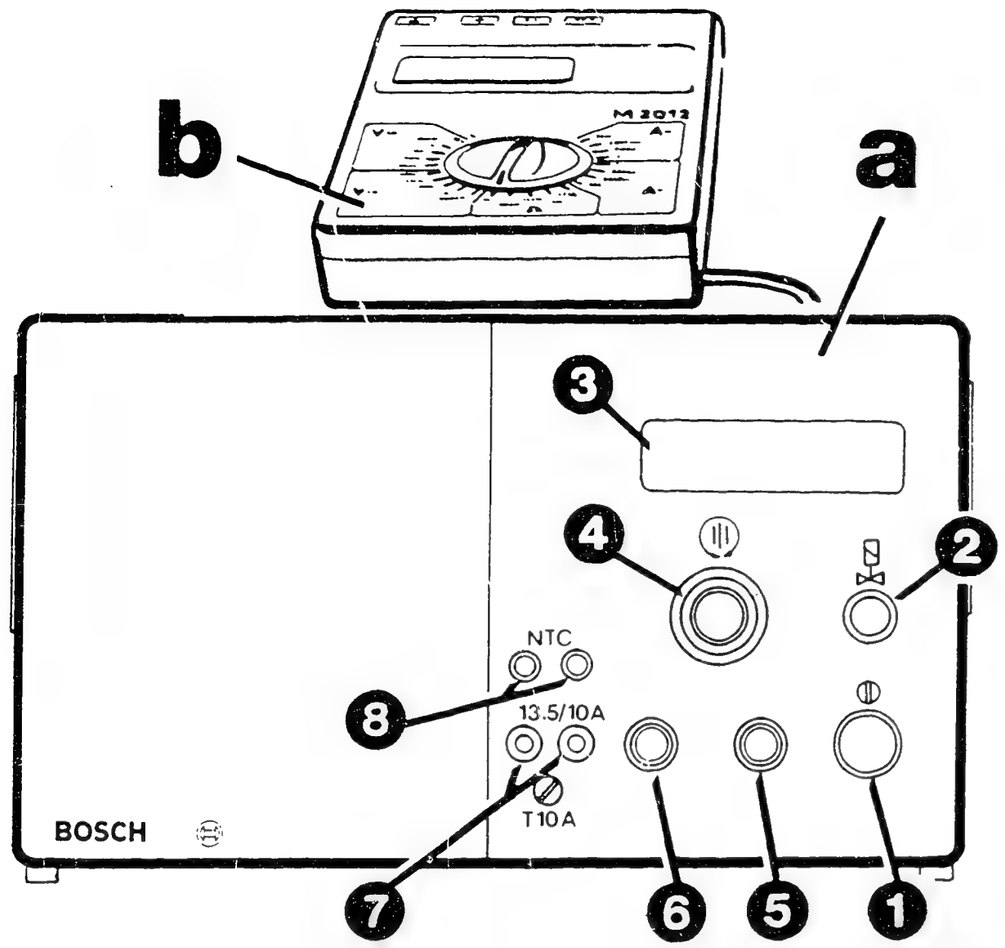


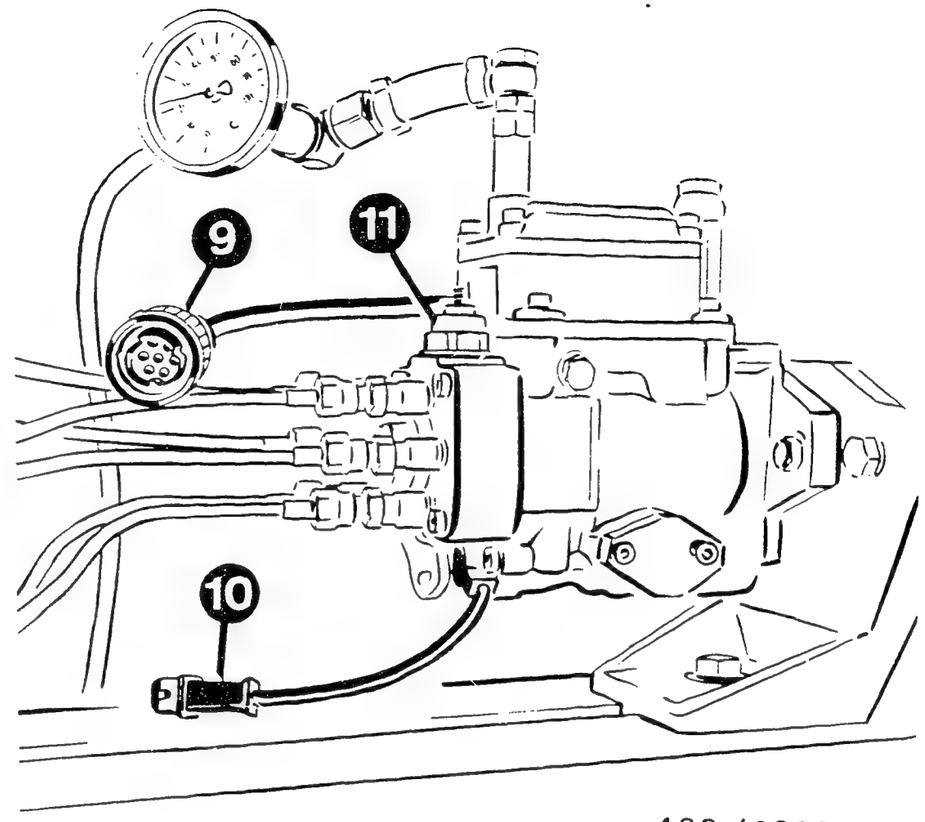
TEST SET-UP (HYDRAULIC TEST)

1 = Coupling half
2 = Universal clamping bracket
3 = Clamping flange
4 = Timing-device measuring instrument
5 = Test-pressure line
6 = Holding device
7 = Calibrating nozzle-holder assembly
8 = Reducing coupling
9 = Connecting line
10 = Reducer bushing (reducing fitting with spray damper cap) and reduction sleeve (reduction sleeve with inner grooves)
11 = Testing device with pressure gauge
12 = Overflow restriction
13 = Temperature indicator
14 = Return line

B11 —⟹

B12 —⟺

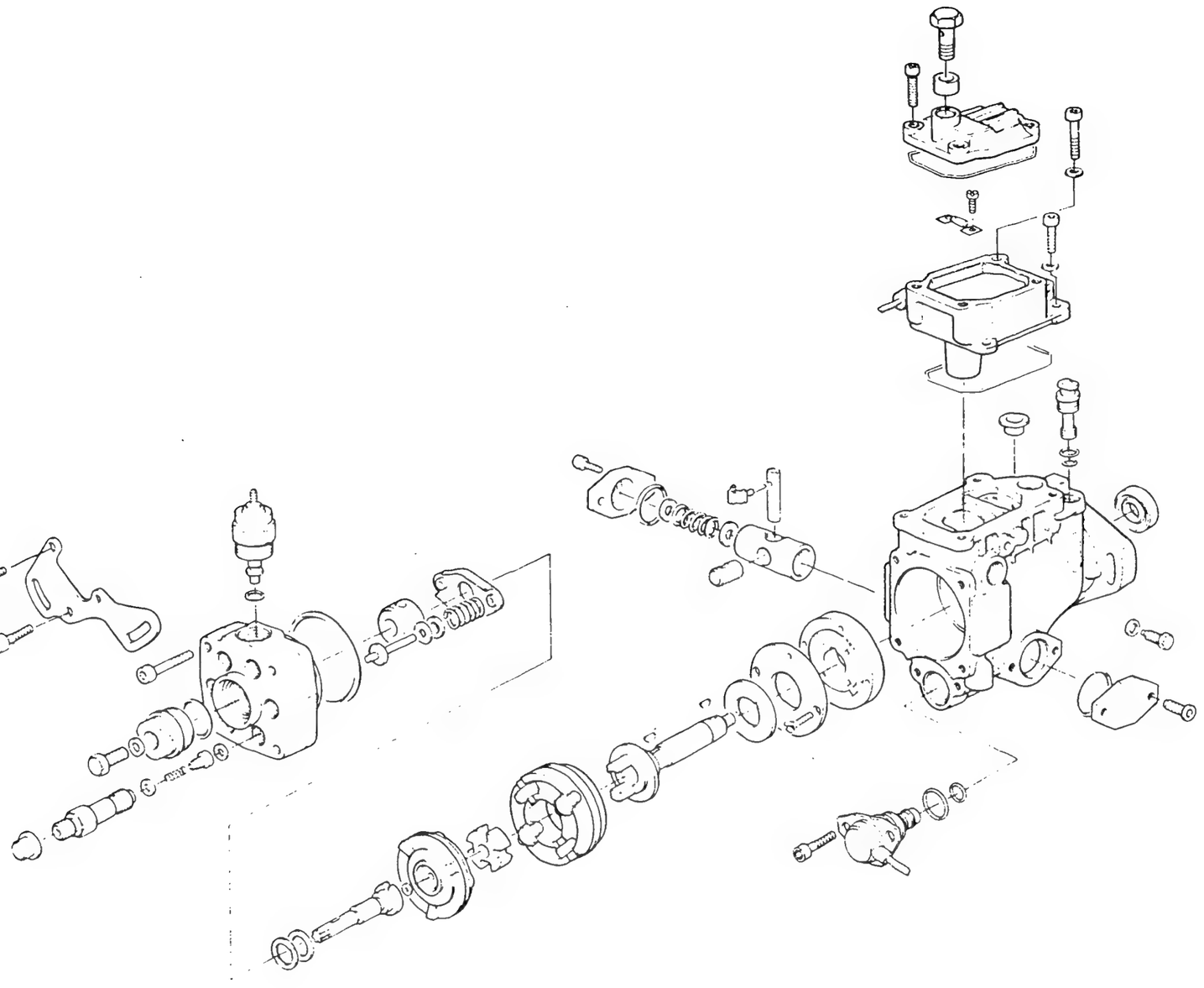




460 / 2099

a = Tester EDC-VE
1 = On/off switch
2 = Switch, solenoid valve, start of injection
3 = Display, check-back voltage (4 1/2-digit display)
4 = Potentiometer (setting, check-back voltage)
5 = Plug, connecting cable (9-pole)
6 = Plug, connecting cable (4-pole)
7 = Sockets 13.5 V 10 A, voltage supply ELAB
8 = Sockets, temperature sensor (fuel)
b = Multimeter (measurement of resistance, temperature sensor, fuel)

TEST SET-UP (CONTINUED)
Make connections between tester (5) and injected-quantity-adjuster plug (9) and between tester (6) and solenoid valve, start of injection (10) using (9-pole) connecting cable and 4-pole connecting cable respectively. Connect multimeter to sockets (8). Connect ELAB (11) to sockets (7).

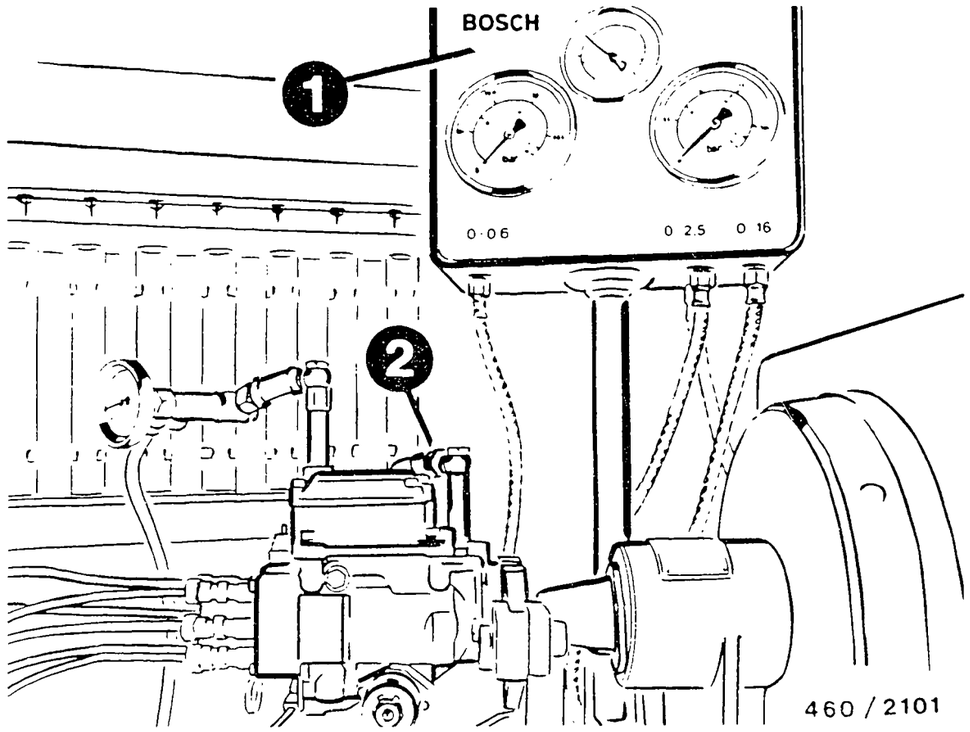


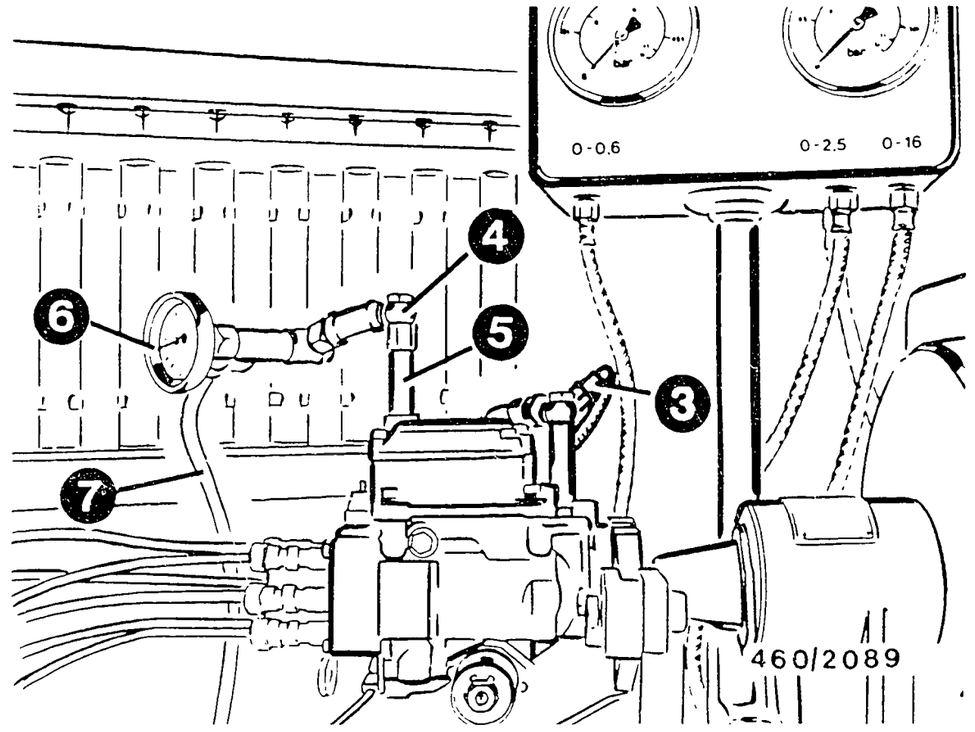
460/2100

EXPLODED VIEW VE..E.. DISTRIBUTOR-TYPE FUEL INJECTION PUMP

B15 ⟹

B16 ⟸

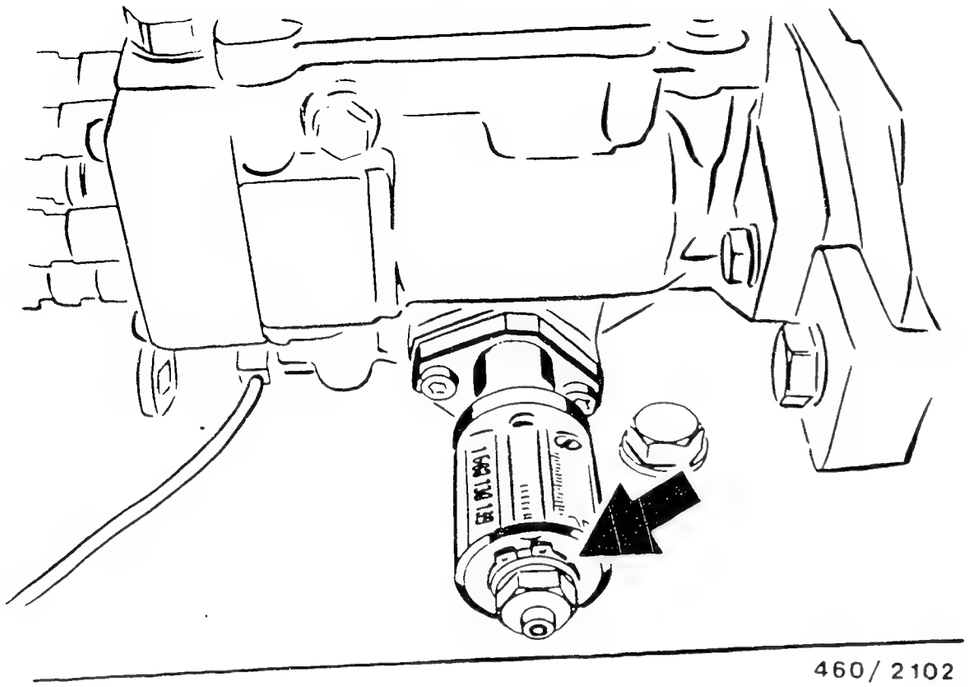




CLAMPING FUEL-INJECTION PUMP

Attach fuel-injection pump with appropriate clamping bracket and flange to test bench such that play-free drive coupling is subjected to tensile stress, i.e. pull clamping bracket with clamped pump in direction opposite to drive and at the same time tighten fastening screw.
Attach testing device (1) to test bench. Connect inlet hose (2) to distributor-type fuel-injection pump with fitting 1 683 370 011 (contained in set of parts for testing device).

Connect pressure gauge 0...0.6 bar - for measuring inflow - to inlet (3). Connect pressure gauge 0...16 bar - for measuring supply pump pressure - to outlet ahead of overflow restriction (4). To do so, make use of inlet-union screw (5) 1 683 456 000 and inlet union 1 683 385 011 (contained in set of parts). Connect temperature indicator (6) with overflow restriction (4). Route overflow with plastic hose (7) from temperature indicator back into calibrating-oil reservoir.

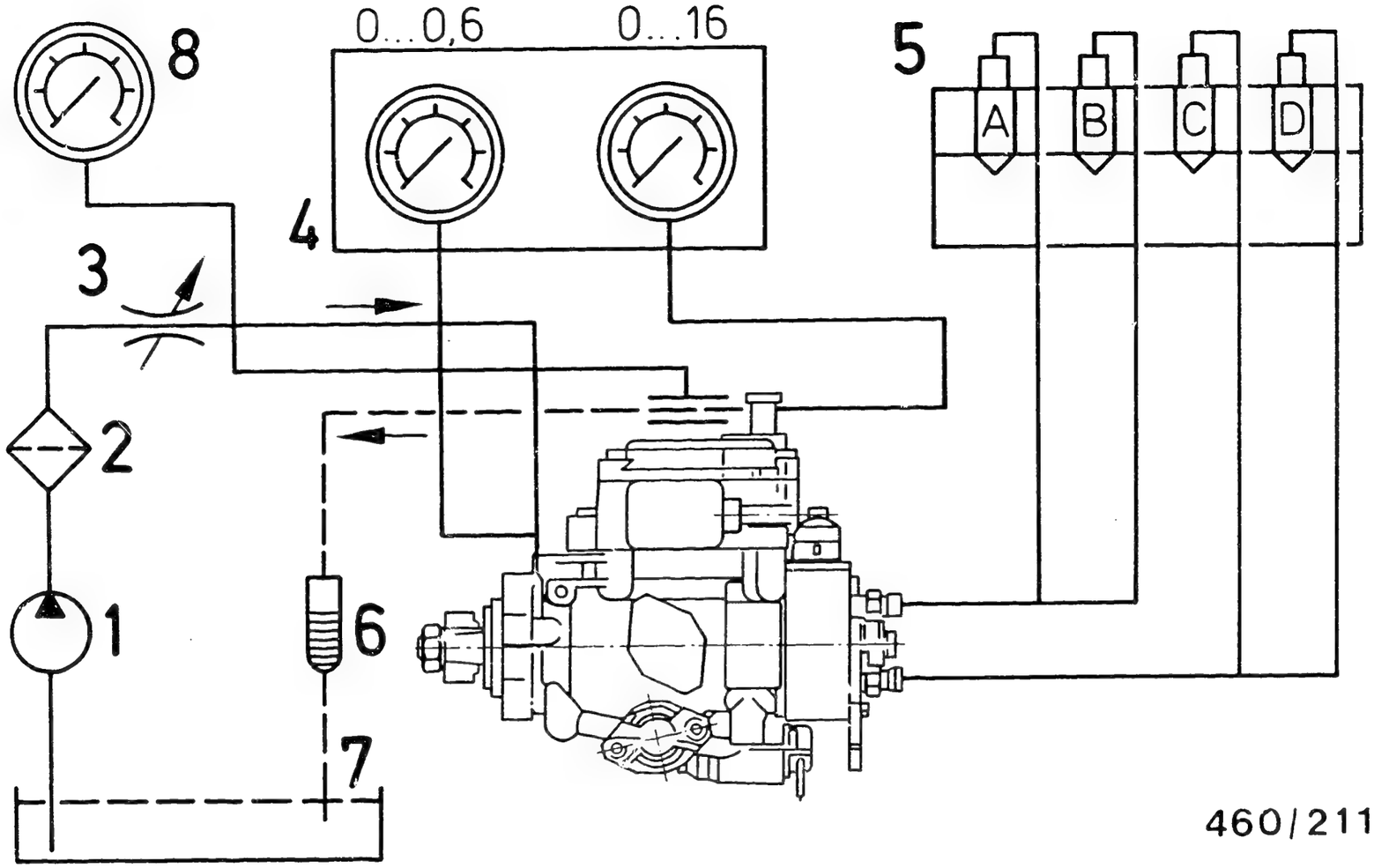


460/ 2102

MOUNTING TIMING-DEVICE MEASURING INSTRUMENT

Attach measuring instrument opposite spring side of timing device. To do so, unscrew closing cover. Check zero position of measuring instrument. Should correction be necessary, move scale plate accordingly in instrument. For this purpose, remove locking ring (picture, arrow) and detach sight glass.

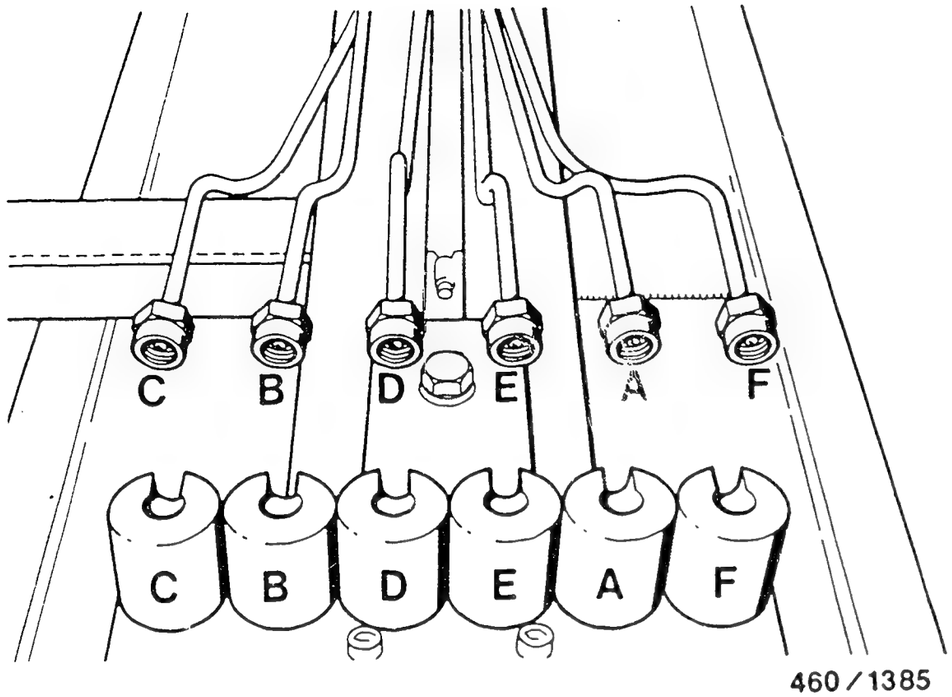
For production reasons:
continued on the following coordinate.



1 = Supply pump
2 = Filter
3 = Pressure regulation, inlet
4 = Testing device with pressure gauge
5 = Nozzle-holder assembly with nozzles
6 = Graduate for overflow
7 = Calibrating-oil reservoir
8 = Temperature indicator with overflow restriction

DIAGRAM OF LINES VE..E.. (hydraulics)

Route fuel-injection tubing in accordance with letters marked on distributor head to nozzle-holder assemblies.



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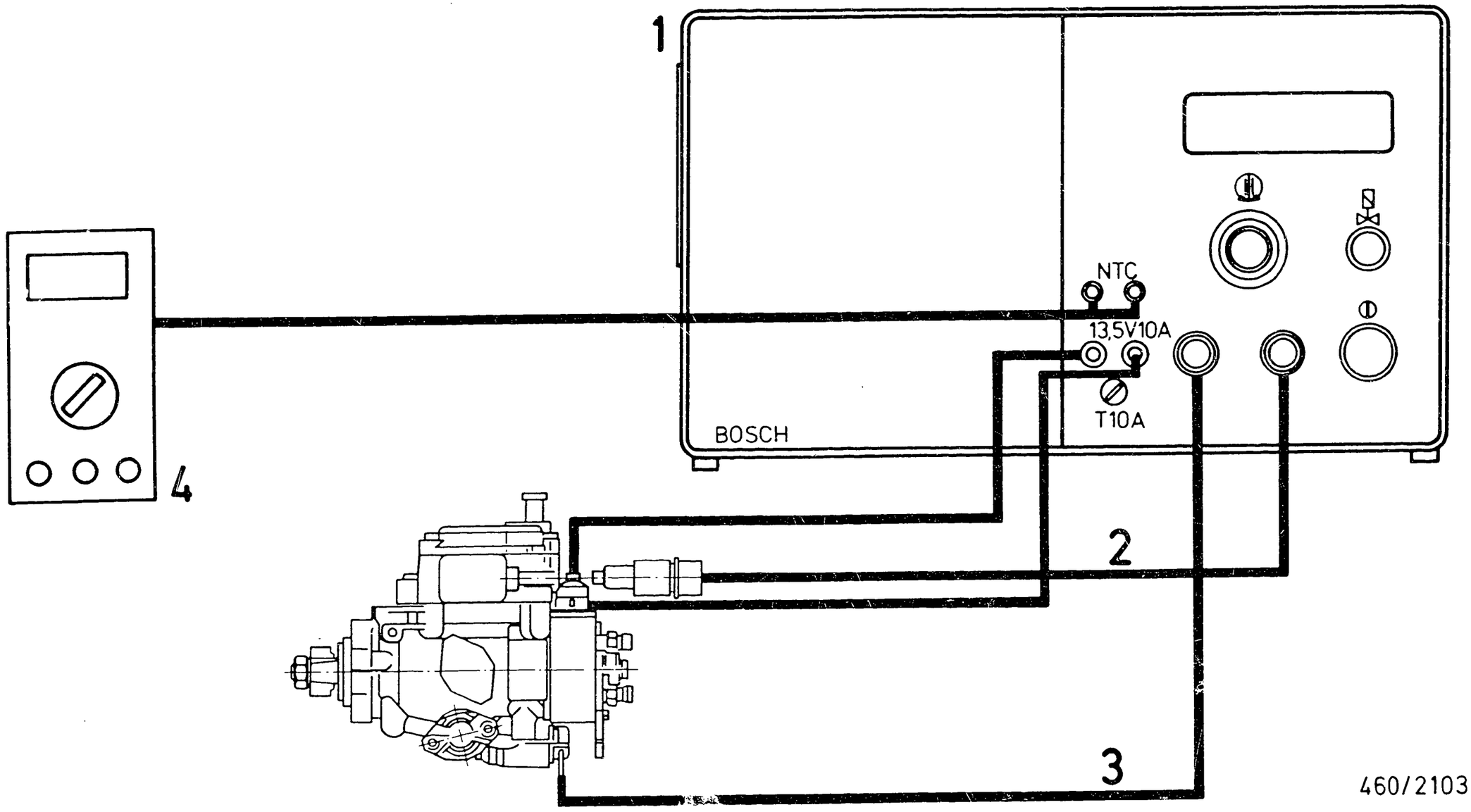
Note on assembly of 450 mm long test-pressure lines:
Bend test-pressure lines as shown in picture.
Mark union nuts of test-pressure lines in accordance with pump outlets (A...F).
This guarantees that the test-pressure lines do not have to be constantly re-bent.

B23 — ⟺

For production reasons:
continued on the following coordinate.

B24 — ⟺



460/2103

1 = Tester VE-EDC
2 = Connecting cable, injected-quantity adjuster
3 = Connecting cable, solenoid valve, start of injection
4 = Multimeter

WIRING DIAGRAM VE..E.. (electrics)

INCOMING INSPECTION OF PUMP
Hydraulic test

Observe direction of rotation of pump.

Switch on pre-supply pump for calibrating oil.

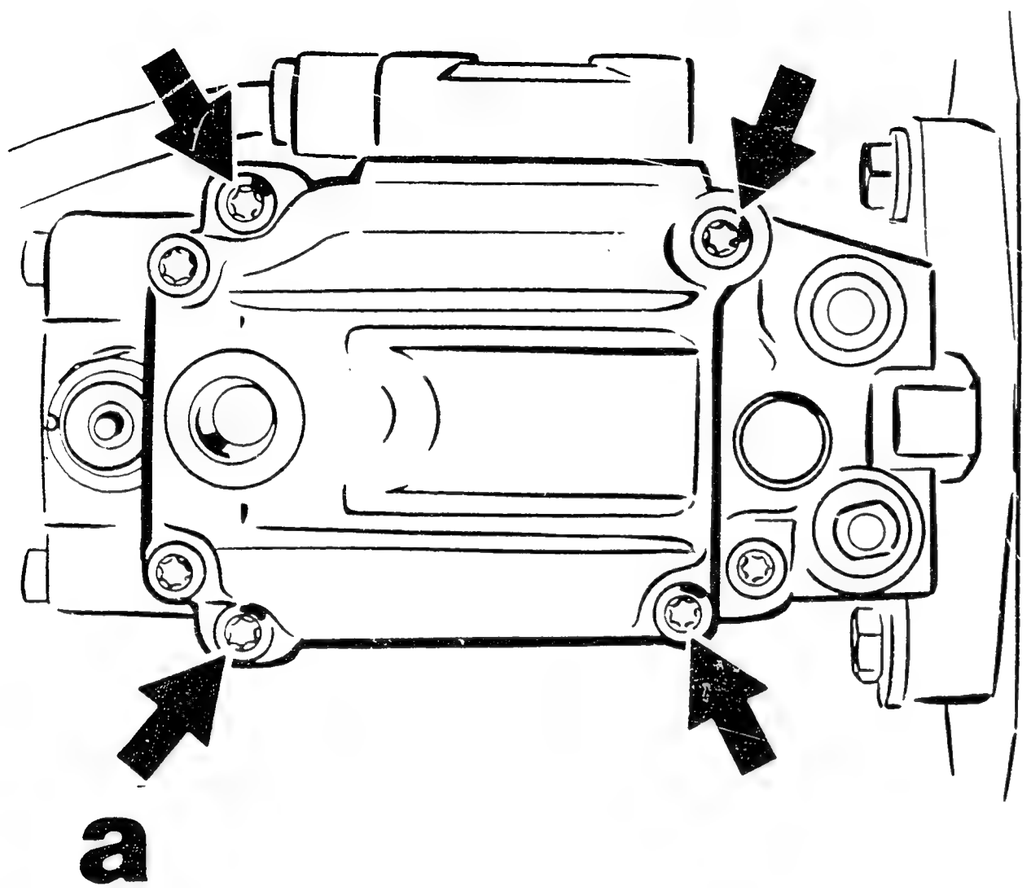
Allow pump to warm up.

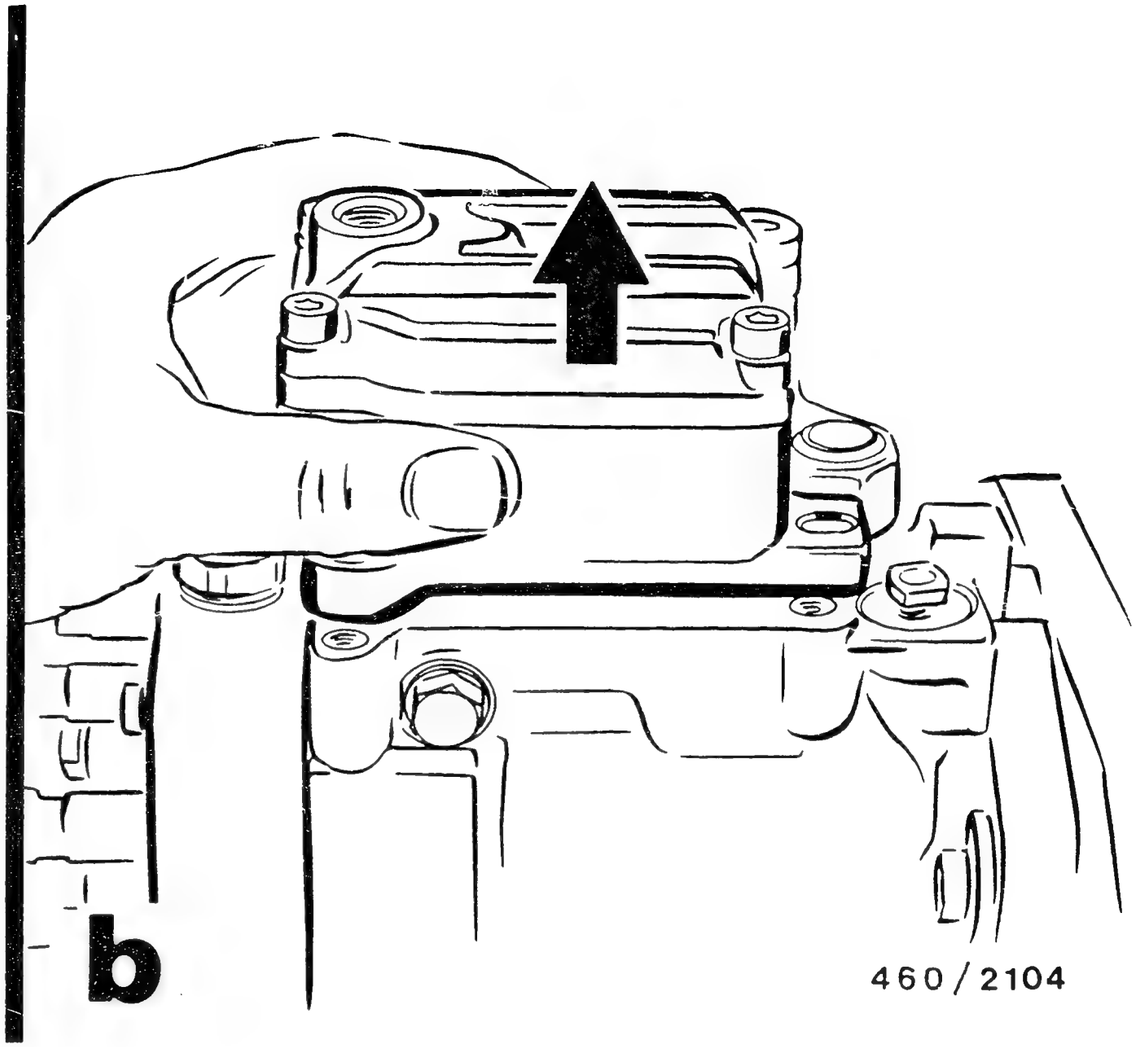
Note:
Given constant check-back voltage, pump must not be allowed to run for more than 15 minutes.

Incoming inspection on the test bench is performed in the same order as the test sequence.

Note:
As regards incoming inspection, the applicable values are the values in parentheses on the test-specification sheet (pay attention to injected-quantity scatter). Enter values determined in test record. If the values have to be corrected, the test specifications not in parentheses apply.

For production reasons:
continued on the following coordinate.





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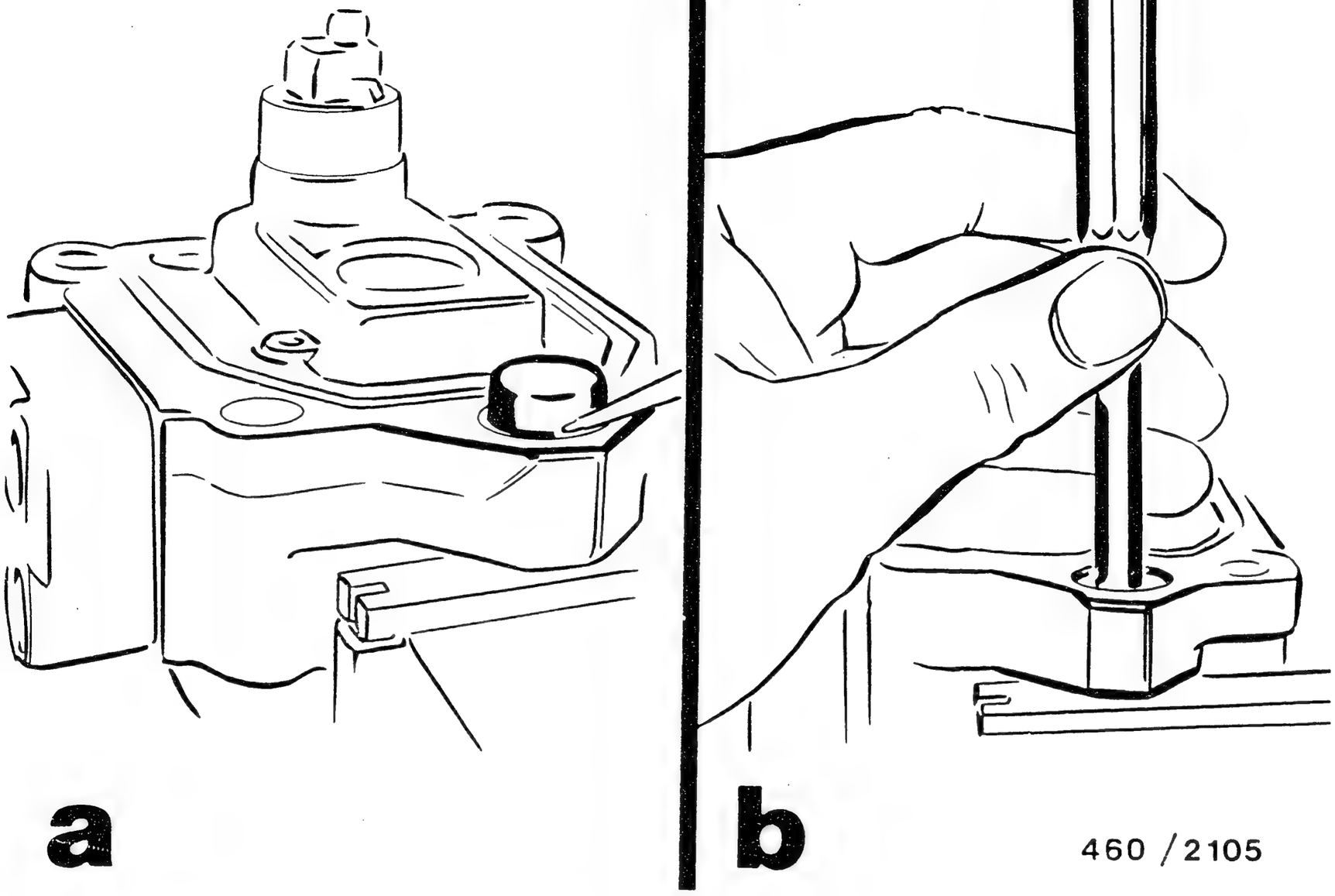
STATIC PREADJUSTMENT OF PUMP

To correct the injected-quantity setting, the injected-quantity adjuster is to be moved axially on the cylinder block. In order to be able to do so, the sealing compound, which secures the injected-quantity adjuster in position on the cylinder block, must be removed.
Remove return line.
Remove fastening screws (picture a, arrows). Lift off injected-quantity adjuster perpendicularly (picture b). If this is not possible, loosen plastic plug by tapping gently against injected-quantity adjuster using a plastic hammer.

C01 — ⟹

C02 — ⟺



Clamp injected-quantity adjuster in a vice with plastic jaws. Knock off plastic plug.
In doing so, the contact surface of the injected-quantity adjuster must not be damaged (picture a).
Knock out part remaining in housing of injected-quantity adjuster with a punch (picture b).
Clean sealing surface at cylinder block to remove reminants of plastic.

The above-mentioned operations can be dispensed with if a new injected-quantity adjuster is fitted.

Attach injected-quantity adjuster to cylinder block. In doing so, make sure that the spherical bolt engages in the control spool.

Position fastening screws approximately in the center of the slots in the injected-quantity adjuster and tighten slightly by hand (exert pressure on seal until sealing surfaces are on top of one another).

Attach return line.

PUMP RUN-IN

Pay attention to direction of rotation of pump.

Switch on pre-supply pump for calibrating oil.

Allow pump to warm up.

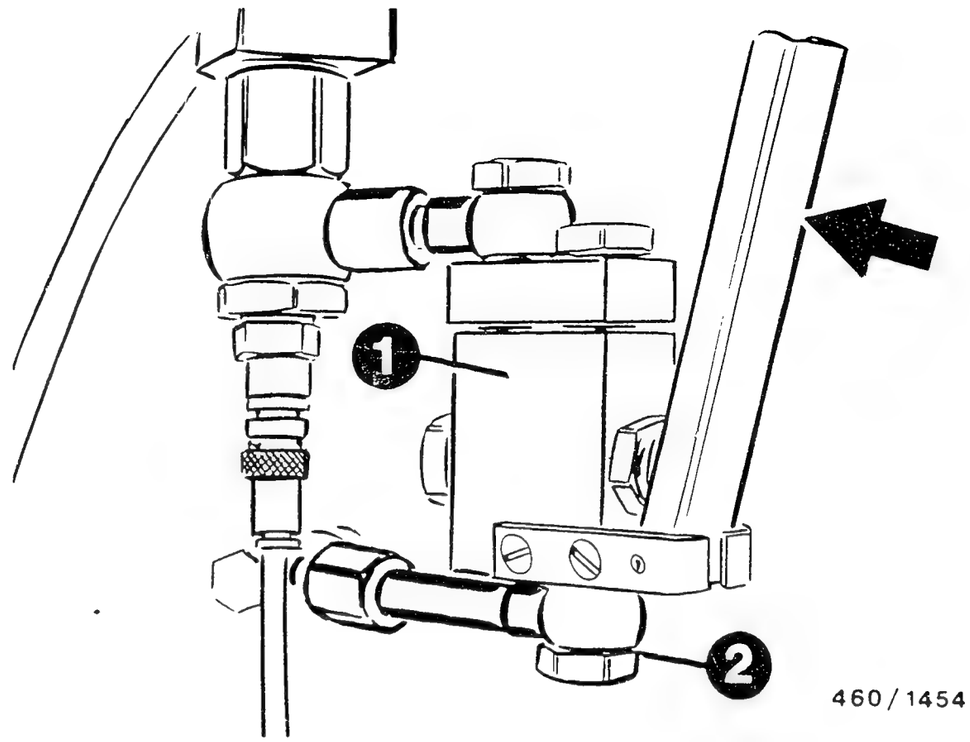
Note:
A c o n s t a n t check-back voltage must not be applied for more than 15 minutes.

40...48 °C if use is made of temperature indicator 1 687 230 029,
42...50 °C if use is made of electronic temperature measuring instrument.

ADJUSTMENT PROCEDURE WITH TEMPERATURE INDICATOR

Regulate inlet temperature by opening or closing restriction (installed in injection-pump test bench).

Note:
Pump (test specimen) must provide delivery.
Permitted temperature in tank during entire measurement approx. 35 °C.
If the overflow temperature 45 ± 3 °C is overshot or undershot during delivery measurement, pump and calibrating oil must be cooled down for a brief period without delivery measurement at lower nominal speed of pump or warmed up at upper nominal speed.



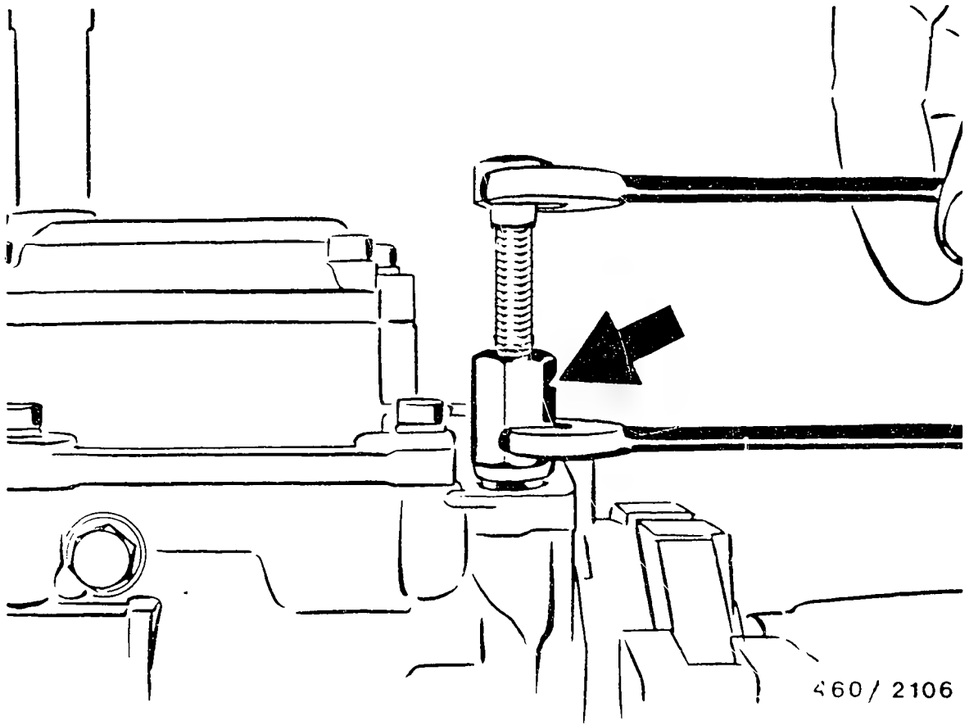
1 = Flushing valve
2 = Overflow restriction

ADJUSTMENT PROCEDURE WITH ELECTRONIC TEMPERATURE MEASURING INSTRUMENT

A flushing valve is employed when using the electrical temperature measuring instrument, so as to shorten the cooling-down times.

Mode of operation:
Actuating the hand lever (picture, arrow) bypasses the built-in overflow restriction. As a result, a larger quantity of calibrating oil flows through the pump and the prescribed overflow temperature is reached more quickly.

Note:
The flushing valve must not be pressed during measurement.



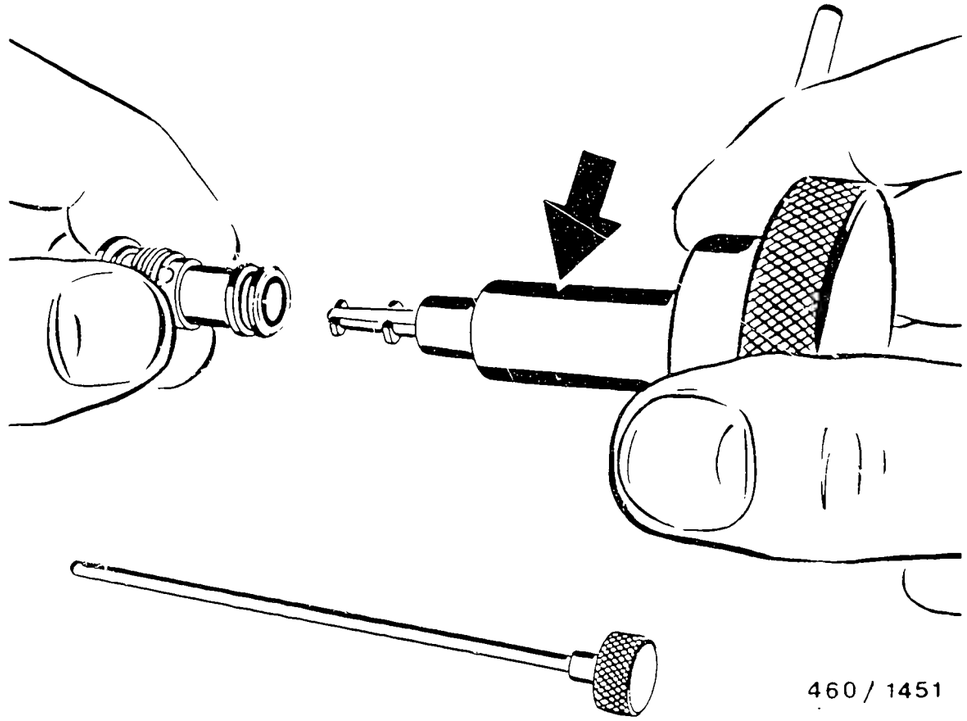
SETTING SUPPLY PUMP PRESSURE

Drive fuel-injection pump at prescribed speed.
Set check-back voltage on tester VE-EDC.

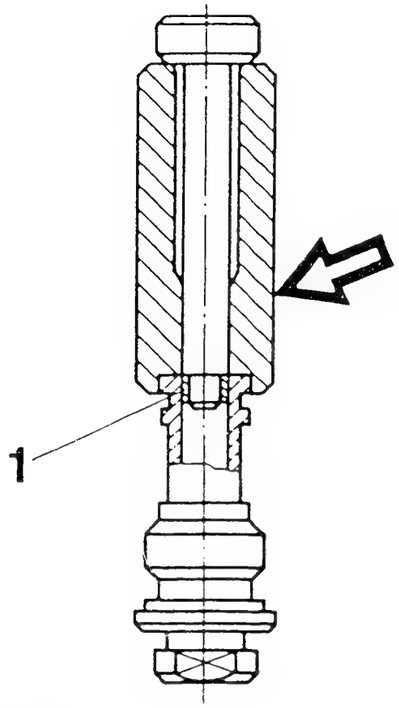
Slip pressing-in tool KDEP 1092 (picture, arrow) on to pressure regulator and turn through 90°.

The supply pump pressure is increased and thus the timing-device travel "advanced" by pressing the plug into the pressure regulator with the pressing-in tool KDEP 1092.

If the pressure is to be reduced, the plug must be turned back as follows: remove pressure regulator with socket wrench KDEP 1086.



Remove clamping sleeve with extractor KDEP 1027 (picture, arrow).
Remove piston and pressure spring and press plug outwards.
Then install pressure spring and piston again in pressure regulator.



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1 = Clamping sleeve

Press in new clamping sleeve with pressing-in tool KDEP 1093 (picture, arrow) such that it is flat.

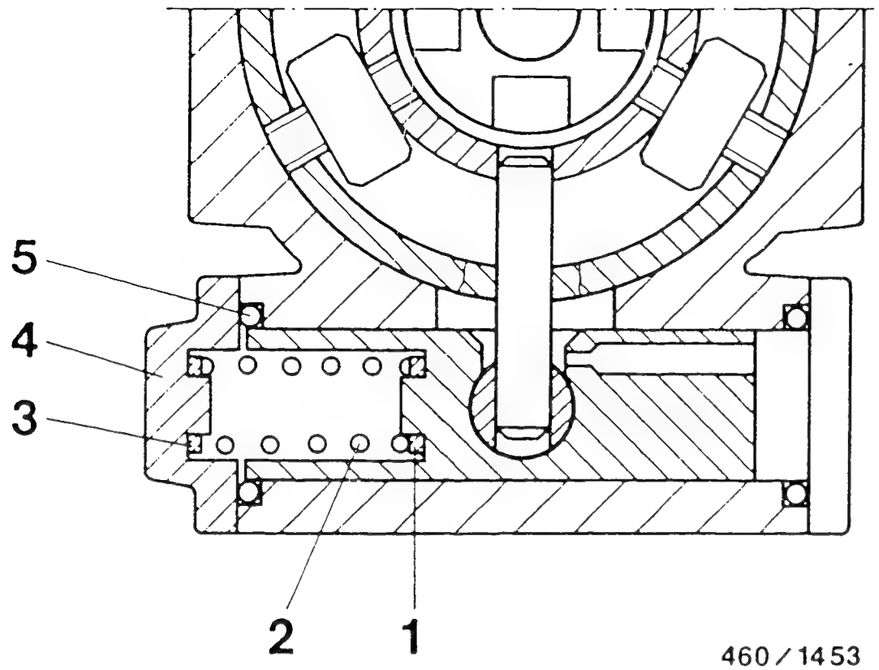
Install pressure regulator and tighten with tightening torque 7...10 Nm.

SETTING TIMING-DEVICE TRAVEL

Run fuel-injection pump at prescribed speed.
Set check-back voltage on tester VE-EDC.
If necessary, switch on solenoid valve - start of injection.

Vent timing-device-travel measuring instrument at slotted screw (end face).

If the prescribed timing-device travel is not attained despite utilization of the supply-pump-pressure tolerance, this can be altered by changing the initial tension of the spring in the timing device.

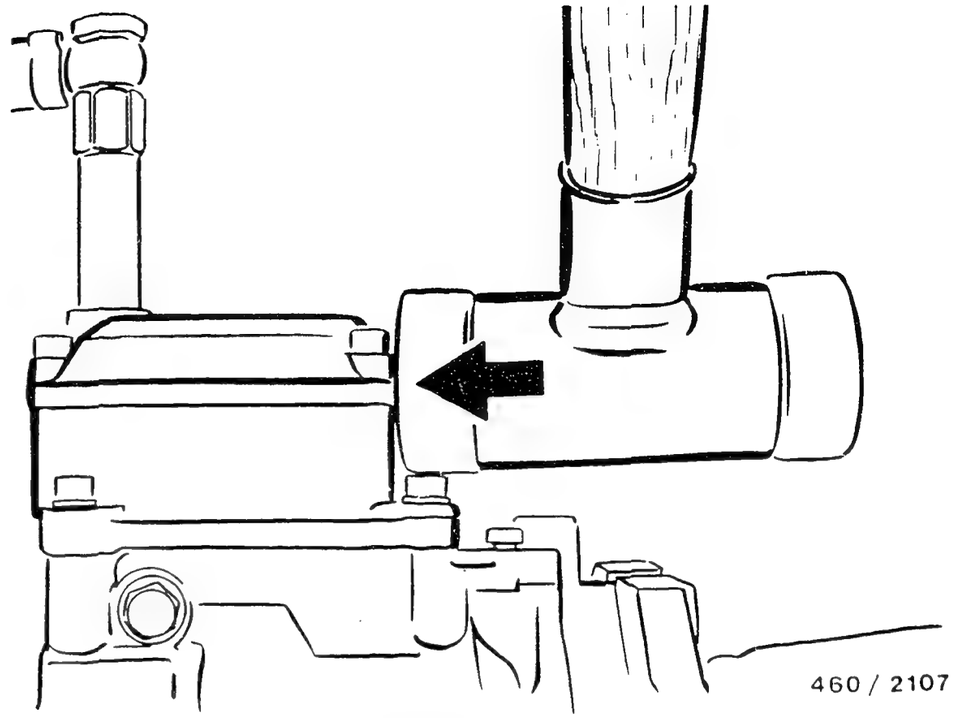


460 / 1453

1 = Shim(s)
2 = Pressure spring
3 = Washer(s)
4 = Closing cover
5 = Seal ring

The initial spring tension can be altered by replacing washers (dimension "SVS" in test-specification sheet).

Remove timing-device cover. Measure thickness of existing washer assembly consisting of items 1 and 3 (pay attention to shim) and compare with dimension "SVS" in test-specification sheet.
Fit shim 0.6 mm in timing-device piston. Fit pressure spring, insert seal ring and install closing cover with remaining shims (these produce the dimension "SVS").
Note: at least one washer must be installed on either side of the pressure spring; max. 3 mm thick. The SVS dimension is the maximum dimension.



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ADJUSTING FULL-LOAD DELIVERY

Run fuel-injection pump at prescribed speed.
Set check-back voltage on tester VE-EDC.
If necessary, switch on solenoid valve, start of injection.
Measure injected quantity.

If the measured delivery is l e s s than the set value indicated in the test-specification sheet, then the position of the injected-quantity adjuster must be changed. An increase in injected quantity is achieved by carefully tapping with a plastic hammer in the direction of the high-pressure outlets.

If the measured delivery is
g r e a t e r than the set value
indicated in the test-specification
sheet, the position of the injected-
quantity adjuster must be altered.
A reduction in injected quantity is
achieved by tapping gently with a plastic
hammer in the direction of the pump drive.

Note:
S m a l l changes in the position of the
injected-quantity adjuster already result
in l a r g e changes in quantity injected.

As a general rule, injected-quantity adjustment
is a l w a y s in the e x c e s s fuel
direction.

Tighten tightening screws on injected-quantity
adjuster with tightening torque 7...10 Nm.

Measure delivery.

If the measured delivery deviates from the set
value indicated in the test-specification sheet,
then correction is to be effected.

Consecutively loosen fastening screws
at injected-quantity adjuster and tighten
again by hand.

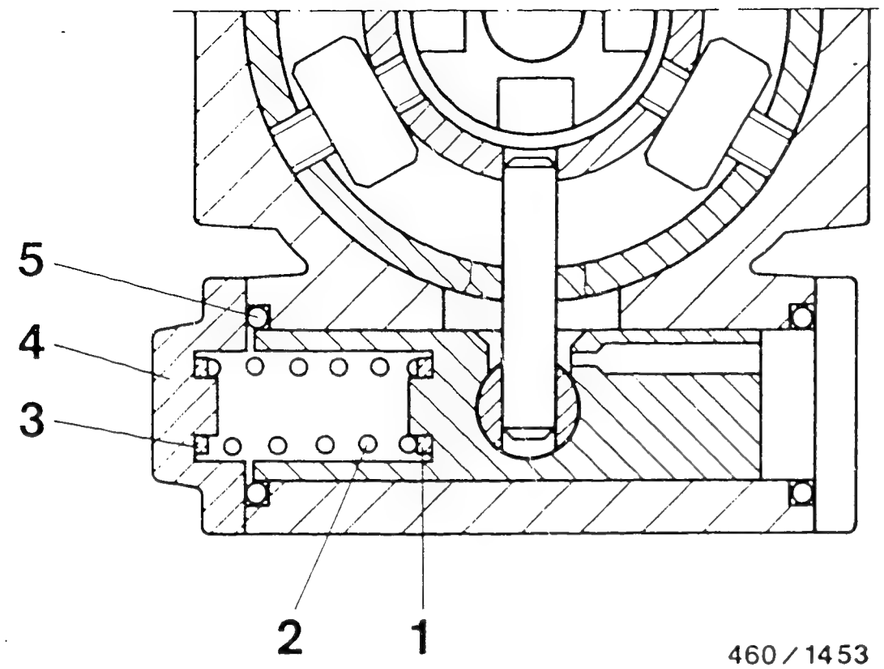
A change in position by tapping with
a plastic hammer on the injected-quantity
adjuster effects the following:
- An increase in delivery in the high-pressure-
  outlet direction
- A reduction in delivery in the pump drive
  direction

Following delivery correction, tighten fastening
screws to prescribed torques.
Measure delivery.

The procedure is to be repeated should
further correction be necessary.

TESTING AND ADJUSTING TIMING-DEVICE TRAVEL

If the timing-device travel values are not
attained given utilization of the supply-pump-
pressure tolerance, adjustment can be effected
by altering the initial spring tension in the
timing device.
The initial spring tension is altered by
replacing the timing-device shims.



460 / 1453

1 = Shim(s)
2 = Pressure spring
3 = Washer(s)
4 = Closing cover
5 = Seal ring

Remove timing-device cover.
Measure thickness of existing washer assembly comprising items 1 and 3 (take account of shim) and compare with dimension "SVS" in test-specification sheet.

Insert shim 0.6 mm thick in timing-device piston. Fit pressure spring, insert seal ring and install closing cover with remaining shims (these produce the dimension "SVS").
Note:
There must be at least one washer on either side of the pressure spring; max. 3 mm thick.
The SVS dimension is the maximum dimension.

Causes of trouble in the event of divergent timing-device-travel set values

- Faults at supply pump and pressure regulator influence the timing-device-travel profile and the supply-pump-pressure profile.

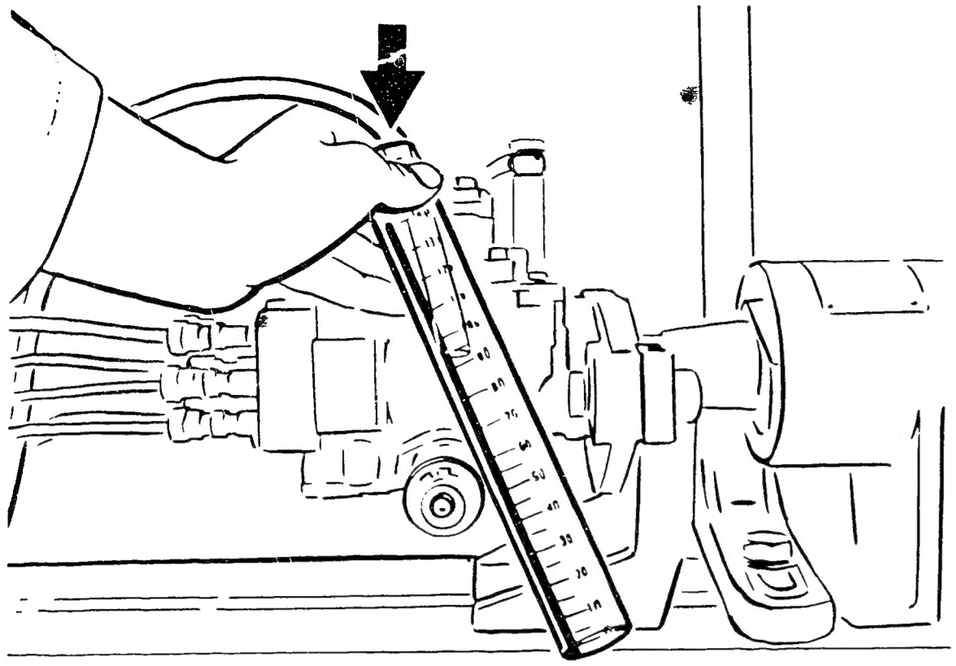
- Faults at the timing device (e.g. wrong spring) affect the profile of the timing-device travel.

- Faults at the solenoid valve affect the profile of the timing-device travel.
  The O-ring must be removed following disassembly of the solenoid valve.
  Causes:
- O-ring leakage
- Sticking valve
- Clogged filter
- Electrical faults

Remove timing-device-travel measuring instruments.

Fit tightening-device cover with new O-ring.

Tighten fastening screws with 10...14 Nm tightening torque.



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MEASURING OVERFLOW

Measure overflow at suitable speed using an appropriate graduate at fuel return line.

Measured quantity is cm3 /10 s.

TESTING FUEL-DELIVERY CHARACTERISTICS

Set prescribed speed and then corresponding check-back voltage with adjustment potentiometer. If necessary, switch on solenoid valve, start of injection.

Measure delivery.

Repeat procedure for each fuel-delivery characteristic value.

If the check-back voltage cannot be set, this may be due to the following:

* Mechanical fault at adjuster
* Control spool not moving freely
* ELAB sticking

ADJUSTING FULL-LOAD DELIVERY

Fuel-injection pump at prescribed speed. Set check-back voltage on tester VE-EDC. If necessary, switch on solenoid valve - start of injection. Measure injected quantity.

If the measured delivery is l e s s than the set value indicated in the test-specification sheet, the position of the injected-quantity adjuster must be altered. An increase in injected quantity is achieved by tapping gently with a plastic hammer in the direction of the high-pressure outlets.

If the measured delivery is g r e a t e r than the set value indicated in the test-specification sheet, the position of the injected-quantity adjuster must be changed. A reduction in injected quantity is obtained by tapping gently with a plastic hammer in the direction of the pump drive.

Note:
S m a l l changes in the position of the injected-quantity adjuster already produce l a r g e changes in quantity injected.

As a general rule, injected-quantity adjustment is a l w a y s to be performed in the e x c e s s f u e l direction.

Tighten fastening screws at injected-quantity adjuster with prescribed torque 7...10 Nm.

Measure delivery.

If the measured delivery deviates from the set value given in the test-specification sheet, then correction is to be effected.

Consecutively loosen fastening screws at injected-quantity adjuster and tighten again by hand.

A change of position brought about by tapping with a plastic hammer on the injected-quantity adjuster effects the following:
* An increase in delivery in the high-pressure outlet direction
* A reduction in delivery in the pump drive direction

After correcting delivery, tighten fastening screws with prescribed tightening torque 7...10 Nm.
Measure delivery.

The procedure is to be repeated should further correction be necessary.

TESTING STARTING DELIVERY

Run fuel-injection pump at prescribed speed.
Set check-back voltage on tester VE-EDC.
If necessary, switch on solenoid valve -
start of injection.
Measure delivery.

TESTING IDLE DELIVERY

Run fuel-injection pump at prescribed speed.
Set check-back voltage on tester VE-EDC.
If necessary, switch on solenoid valve -
start of injection.
Measure delivery.

TESTING SHUTOFF DELIVERY

Run fuel-injection pump at prescribed speed.
Set check-back voltage on tester VE-EDC.
Switch off solenoid valve, start of injection.
Disconnect voltage supply to ELAB.
Measure delivery.

If the measured delivery is g r e a t e r
than the set value indicated in the test-
specification sheet, then the causes
of the trouble may be as follows:

* Inlet hole in distributor head dirty.

* O-ring leakage

* Sticking ELAB piston or piston not moving
freely

* Return spring in ELAB broken

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